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IS 11649-1 (1986): Aluminium honeycomb sandwich panel for civil aircraft floors, Part 1: General design criteria [TED 14: Aircraft and Space Vehicles]

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IS : 11649 (Part 1) - 1986

Indian Standard (Reaffirmed 2002)

SPECIFICATION FOR ALUMINIUM HONEYCOMB SANDWICH PANEL FOR CIVIL AIRCRAFT FLOORS

PART 1 GENERAL DESIGN CRITERIA

Aircraft and Space Vehicle Sectional Committee, EDC 74; Panel for Aluminium Honeycomb Sandwich Panels for Aircraft, EDC 74:P-3 [Ref: Doc: EDC 74 (3888)]

1. Scope — Covers the general design criteria, material and performance requirements for aluminium honeycomb floor panels for use on civil aircraft. The scope of this specification is limited to aluminium, hexagonal type honeycomb core sandwiched between aluminium alloy face sheets. The various method of tests for floor panels are covered in Part 2 of the specification.

2. Materials

2.1 All materials used in the construction of sandwich panel shall conform to relevant or equivalent Indian Standard specifications for aircraft quality. In the absence of any relevant specification the procedure outlined in Appendix A shall be followed for the properties of honeycomb cores and adhesives. Typical properties of aluminium honeycomb cores are given in IS : 11642 (Part 1)-1986 'Specification for aluminium hexagonal honeycomb core : Part 1 General requirements'.

2.2 All types of inserts used shall be as agreed to between the purchaser and the supplier. They shall conform to the safety and statutory regulations of the certifying authorities.

3. Shape, Dimensions and Classification

3.1 Aircraft floor panels are flat platforms on which movement of crew, passengers and cargo is performed. They are generally rectangular, trapezoidal and skewed in shape and are fitted on several longitudinal and transverse beams. A typical honeycomb floor panel is shown in Fig. 1.

3.1.1 Floor panels are classified into four categories as given below:

Type A — Underseat area, low traffic

Type B — Gangway, toilet, vestibule, entry and underseat areas, medium traffic only

Type C — Gangway, toilet, vestibule and entry areas, particularly suited to high traffic areas

Type D — Suited to baggage compartment floors.

4. General Design Criteria for Civil Aircraft Floor Panels

4.1 The general design criteria to be considered for aircraft floor panels are:

a) Loads — uniformly distributed, concentrated and insert pullout loads;
b) Stiffnesses;
c) Resistance to indentation;
d) Resistance to rolling indentation;
e) Resistance to impact;
f) Durability and service life;
g) Warppage;
h) Resistance to flame; and
j) Resistance to corrosion.

4.2 In Appendix B, recommended values for the criteria listed above are given for purposes of guidance.

5. Manufacture of Panels

5.1 The panels shall be built to strictly controlled processes to meet the mechanical and physical properties as agreed to between the purchaser and the supplier.

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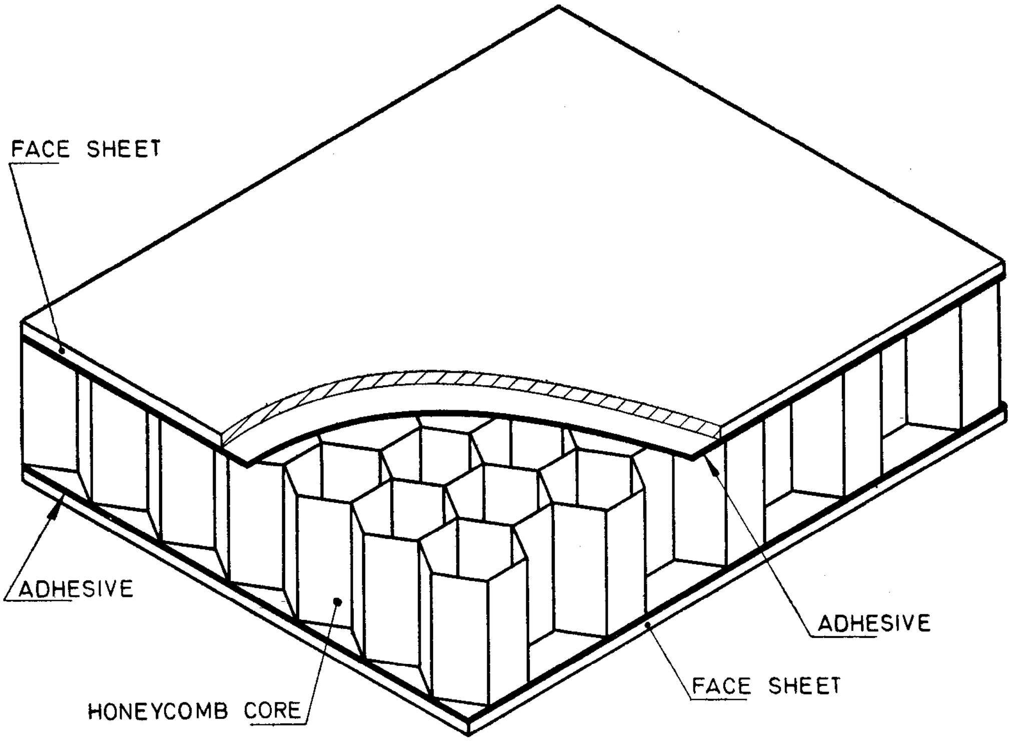

FIG. 1 TYPICAL AIRCRAFT HONEYCOMB FLOOR PANEL

6. Finish

6.1 The complete floor panel shall be protected against undue deterioration or loss of strength/stiffness due to abrasion, corrosion, weathering or similar causes by proper protective treatments.

7. Marking

7.1 Each panel shall have the following markings stencilled with indelible ink or paint:

a) Panel type/part number,
b) Panel serial number,
c) Date of manufacture,
d) Lot number, and
e) Manufacturer's name or trade-mark.

APPENDIX A

(*Clause* 2.1)

STATISTICAL PROCEDURE TO DETERMINE THE MINIMUM VALUE OF MECHANICAL PROPERTIES OF HONEYCOMB CORE AND ADHESIVES

A-1. The mechanical properties of honeycomb core and adhesives shall have the minimum values as agreed to between the purchaser and the supplier or obtained from the empirical statistical formula :

$$A = \bar{X} (1 - K_A V)$$

where

A = value of material property;

$\bar{X}$ = mean-strength of the sample;

V = co-efficient of variation of the sample (co-efficient of variation in strength should be limited to 0·10); and

K_A = tolerance limit factor, the value of which depends on the number of specimens tested, given in Table 1.

TABLE 1 VALUES OF TOLERANCE LIMIT FACTOR, K_A FOR VARIOUS SIZES OF SAMPLES

Sample Size	5	10	15	20	30	50	100
Tolerance limits factor, K_A	5·741	3·981	3·520	3·295	3·064	2·862	2·68

APPENDIX B

(*Clause* 4.2)

GENERAL DESIGN REQUIREMENTS

B-1. Distributed Load — The honeycomb floor panel as a part of the aircraft floor shall be designed to withstand an equivalent distributed load of Xn_z Pascals where X is a constant which depends on the type of floor and n_z is the normal limit load factor of the aircraft.

Note — X is to be obtained from aircraft design.

B-2. Concentrated Load — The floor panel shall be designed to withstand a concentrated load of 365 N (37·2 kgf) with a maximum pressure of 8·90 MPa (90·72 kgf/cm^2).

B-3. Stiffness — The static deflection of the aircraft floor panel shall be designed so that it does not exceed 1/100 of the shorter length of support span when subjected to a load of 740 N (75·5 kgf) applied at the centre of the panel while simply supported in a test frame. The load shall be assumed to be applied during the test by dead weights through a 60 mm diameter flat faced indentor located at the centre of the panel.

B-4. Static Indentation Strength — Static indentation strength of the panel shall be designed to a minimum of 1 098 N (112 kgf) when the load is applied through a 9·5 mm diameter indentor at the centre of a 250 x 250 mm square panel on the walking surface. The other face of the panel shall be fully supported as shown in Fig. 2A through a representative 75 mm food cart wheel on a 300 mm square panel supported on a frame giving 25 mm edge support all round the panel as shown in Fig. 2B.

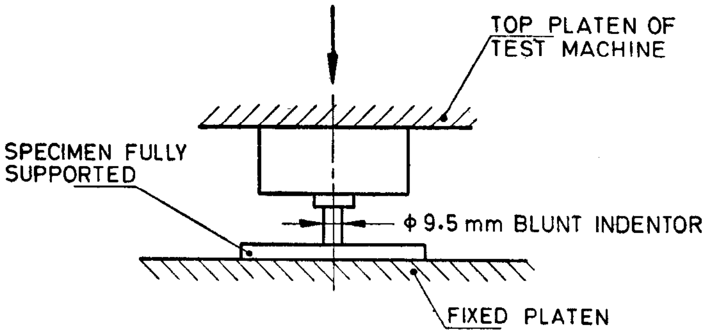

FIG. 2A LOADING ARRANGEMENT FOR FULLY SUPPORTED 9·5 mm DIA STATIC INDENTATION TEST FOR ALL TYPES

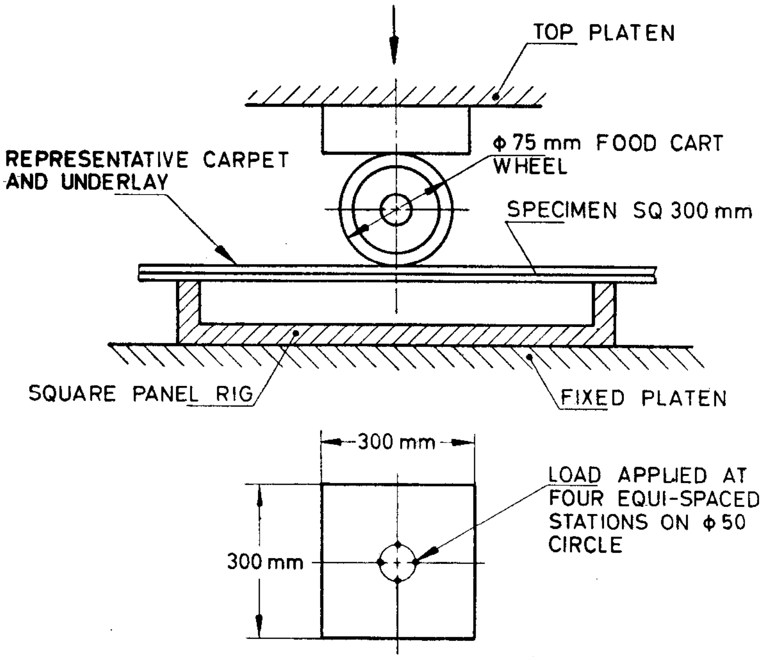

FIG. 2B LOADING ARRANGEMENT FOR FOOD CART WHEEL STATIC TEST FOR B AND C TYPES

B-5. Resistance to Impact — The floor panel with carpet and underlay shall be designed to absorb energy without failure (puncturing of skin or excessive core crushing) as given below :

Type of Floor	*Energy to be Absorbed in* Nm (kgf. m)
A	59 (6)
B, C and D	136 (13·83)

A weight of 88 N (9 kgf) with a spherical radius of 12·7 mm shall be assumed to be dropped on the walking surface from required height on to the floor panel supported on floor beams.

B-6. Durability/Service Life — The panel shall be designed to withstand 150 000 blunt faced impacts in an area during Nobbly wheel fatigue tests. The loads to be applied to the panel during the tests are given below:

Type of Floor	*Load in* N (kgf)
A	216 (22)
B	304 (31)
C and D	392 (40)

B-7. Warppage — Warppage of finished panels shall not exceed 2 mm per metre.

B-8. Resistance to Flame — The degraded properties shall conform to design values after environmental tests.

B-9. Resistance to Corrosion — The degraded properties shall conform to design values after environmental tests.

EXPLANATORY NOTE

This Indian Standard specification has been drawn up for civil aircraft floors.

The other parts prepared are:

IS : 11642 (Part 1)-1986 Aluminium hexagonal honeycomb core: Part 1 General requirements

IS : 11642 (Part 2)-1986 Aluminium hexagonal honeycomb core: Part 2 Methods of test

IS : 11649 (Part 2)-1986 Aluminium honeycomb sandwich panel for civil aircraft floors: Part 2 Methods of test

In the preparation of this standard considerable assistance has been derived from various journals, operation manuals, international standards taking into cognizance the manufacturing practices available in the country. This comprehensive standard aims at helping indigenous manufacture of aircraft floors. Safe life of a panel is not being specified as the same is subject to agreements between the manufacturer and the supplier.

Indian Standards for foils adhesives and for panels other than for floor applications, for example, partition walls for solar panels are under preparation.

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